English For Science and Technology (EST): Learning and Teaching Strategies for High School Students in Malaysia

Fazal Mohamed Mohamed Sultan[1], Gunasegaran Karuppannan[2], Ranjithamalar Kumar[3], Khatipah Abd Ghani[4]

[1]Language & Linguistics Research Center, Faculty of Science Social and Humanities, Universitiy Kebangsaan Malaysia, Selangor, Malaysia

[2]Centre for Graduate Studies, Universiti Selangor, Selangor, Malaysia

[3]English Department, Assunta Secondary School, Selangor, Malaysia

[4]Faculty of Education and Social Sciences, Universiti Selangor, Selangor, Malaysia

Correspondence: Fazal Mohamed Mohamed Sultan, Language & Linguistics Research Center, Faculty of Science Social and Humanities, Universitiy Kebangsaan Malaysia, Selangor, Malaysia.

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Abstract

Programme for International Students Assessment (PISA) 2015 which highlighted Global Rating on Education Quality reported that Malaysia was ranked in the 52nd placing out of 72 countries in assessing students' ability in Science and Mathematics using English language (OED, 2016). This implies that Malaysian students need to improve further on science and technology development. Therefore, this study looked into the learning strategies and problems students face in learning English for Science and Technology (EST) subject and the teaching strategies employed by the teachers. A total of 150 Form Four students from three selected schools were taken as samples for this study. Data was collected using questionnaires. The researchers conducted a structured interview with 27 students from three schools (in Kedah, Selangor and Negeri Sembilan). In order to triangulate the data, the researchers also carried out a classroom observation on the Form Four classes from each of the three states and analysed 30 sample scripts of EST report writing to look at the types of language problems made by students. The study applied a mixed method of quantitative and qualitative. Findings from the 150 students' Likert-scale questionnaires were analysed using a One-Sample T-Test. The responses from the 27 students' interviews were transcribed and analysed using content analysis. The observations carried out in the selected Form Four classes were transcribed in a narrative written report. Overall, the study depicts that the majority of the students face language problems in learning EST. Students were found to be lacking in applying appropriate learning strategies, and teachers still control EST classrooms. Through the findings, this study suggests that a comprehensive and effective learning and teaching strategy, also known as CALLA (Cognitive and Academic Language Learning Approach), will help students elevate their comprehension and application to understand scientific knowledge in a second language effectively.

Keywords: English, English for Science and Technology (EST), learning strategies, teaching strategies, classroom observation.

1. Introduction

The Ministry of Education (MoE) introduced English for Science and Technology (EST) in the Sijil Pelajaran Malaysia (SPM) in 2003 as an additional mechanism for science stream students to understand scientific concepts in English. It is also to cater to the job market's needs that require employees to be proficient in scientific English and deliver the ideas clearly in English. However, since EST was introduced in 2003, there have been various reactions among students, teachers and school administrators in taking EST as part of their Sijil Pelajaran Malaysia (SPM) papers.

Zuraidah (2015) stated in English Language Education Reform in Malaysia that many students have not mastered basic grammatical structures even after ten years of learning English. Moreover, students also resort to their first language when explaining an incomprehensible English passage (Alhamsi & Alsheikh, 2020). The negative assumption among students in EST is that the subject is "heavy" with scientific words and terms with high technical vocabulary. Scientific concepts are to be explained using the English language with complex sentence patterns, which involves many academic reading materials. Students who do not possess the level of proficiency necessary to handle the subject's

content may face difficulty learning it. Moreover, students perceive the subject as not a 'scoring subject' or that it does not contribute any benefit to land themselves future jobs as it is merely another 'English' to be learned. Thus, this has resulted in many students tending to not opt for the subject in the SPM examination.

This study aims to obtain information about the language problems faced by Form Four students in learning English for Science and Technology (EST). The researchers are interested in determining the strategies/approaches that students can employ in learning EST. Looking into the problems of understanding content and the second language in reading and writing, the researchers would like to look into students' learning strategies to comprehend the content and second language in the EST classroom. The researchers would analyse the learning strategies that the respondents employ in understanding and applying technical language and technical content in their writing tasks from this research study. In addition, this study also seeks to obtain information on the teaching strategies that teachers employ in EST classrooms. Language teachers are assigned to teach subject matter in English with unfamiliarity in the subject areas, including science and technology. This is a challenge for language teachers as they possess limited knowledge on scientific content and suddenly find themselves teaching a subject in English without the proper support or training needed.

2. Literature Review

For the literature review on this study, the researchers probe into studies relevant to the Introduction of English for Specific Purposes (ESP) and English for Science and Technology (EST). In addition, this study will also look into learning strategies, language problems in learning scientific English, learning strategies and teacher's role in teaching English for Science and Technology (EST).

2.1 The Emergence of English for Specific Purposes (Esp)

Dudley-Evans and St John (1998) defines the characteristics of English for Specific Purposes (ESP) as "to meet specific needs of the learner, uses the underlying methodology and activities of the disciplines it serves and centred on the language skills, discourse and genres appropriate to these activities". Learner-centeredness was given paramount importance in ESP as learners need interest and attitude influences motivation to learn effectively. This resulted in the need for "increased specialisation in language learning". Dudley-Evans and St John (1998) further claim that pair work or group work and problem-solving activities will allow such differences to occur as every student learns differently.

Louis Trimble, known as the 'father of EST', has introduced English for Science and Technology (EST) as English for Specific Purposes (ESP). Trimble (1985) claims that rhetorical elements in scientific and technical English discourse must be comprehended to learn scientific texts further. He also cites that lexical problems such as sub-technical vocabulary and noun compounds are significant difficulties for non-native speakers of English in learning scientific English. Examples of sub-technical vocabulary as cited by Trimble (1985) are words such as "fast" (literally – quick, technically – resistant to) and "transport" (literally – mechanical means of moving goods, technically – the rate of the processing cycle)" (p.130). The researchers confirm that students need to be exposed to teaching and learning strategies to comprehend EST better.

2.2 Theories of Learning

Theories of learning lay the foundation for the adult learning process. Learning theory explains how learning occurs. It explains what happens when learning takes place; in other words, it turns explanation into practice. The theories discussed for this study are Behaviorism, Humanism, Cognitivism, Constructivism and Social Cognitive Theory. These theories are set as the underlying factors in ensuring effective teaching and learning in classroom conditions.

Behaviourism theory applies to the teaching and learning of Science and Technology (EST) as students change in behaviour from the teacher's learning condition, which results in students' interest in learning the subject in a second language. This depicts a relationship between learning actions with the stimulus that reinforces it.

Student-centered is the central locus in Humanism theory which propagates personal involvement and self-initiation in the learning process. This theory relates to this study as English for Science and Technology (EST) learners direct their learning with self-development in mind. The teachers are set as facilitators, and students are geared towards self-directed learning.

Cognitive theory focuses on the "conceptualisation of students' learning processes" and emphasises "how information is received, organised, stored and retrieved by the mind" (p.50). In other words, learners are actively engaged in the learning context. Ertmer and Newby (2013) stress that Cognitive theory encourages learners to relate new information to existing knowledge in a meaningful way, and instructions given by teachers must be based on students' existing knowledge structure. In summation, students will be able to analyse and synthesise previous schemata with new knowledge begotten. For teachers, cognitive development, memory and instructional design theory can facilitate

learning and plan instruction. This theory was applied to this study in learning English for Science and Technology (EST), where students used their cognitive ability or thinking skills to solve a problem (Ertmer and Newby, 2013).

Learning is how people make sense of their experiences. Thus, learning is the construction of meaning from experiences, as claimed by Lai, Hu, & Lyu (2018), which relates to EST learning as this subject requires students to handle problem-solving matters in the task given by the teacher. Therefore, aspects of constructivism need to be adopted to become self-directed learners. This theory applies to learning English for Science and Technology (EST) as learners can interpret the learning experiences to their future needs and further studies.

Social Cognitive Theory claims that an individual knowledge acquiring process is directly related to observing others within the social environment or context of social interactions (Bandura, 2018). In other words, it states that people learn by observing others. This theory believes that human behaviour is caused by personality, behaviour and environment one grows up in (www.socialcognitivetheory). Bandura also reaffirms that a witnessed behaviour will change the way one thinks or cognition and the environment, influencing one's behaviour. This applies in the EST classroom as students cognitively process information as they learn, observe others, and model their behaviour. As Bandura (2019) have stated, learning is a triangle in which learning, the person and the environment are interactive. This is also relevant to the workplace, where on-the-job training and behaviour can assist in socialising employees in the workplace.

It must be admitted that over the years not many studies have been done in scientific or technical English learning and writing in Malaysia. This is due to the subject being offered as an elective paper in the Malaysian Education system. Not much research on language difficulties or learning strategies employed on technical language learning was done. Therefore, the researcher opines that although the point of issue is students' perspective in learning English for Science and Technology and learning strategies employed, there are many other angles that the study can zoom into.

3. Conceptual Framework of This Study

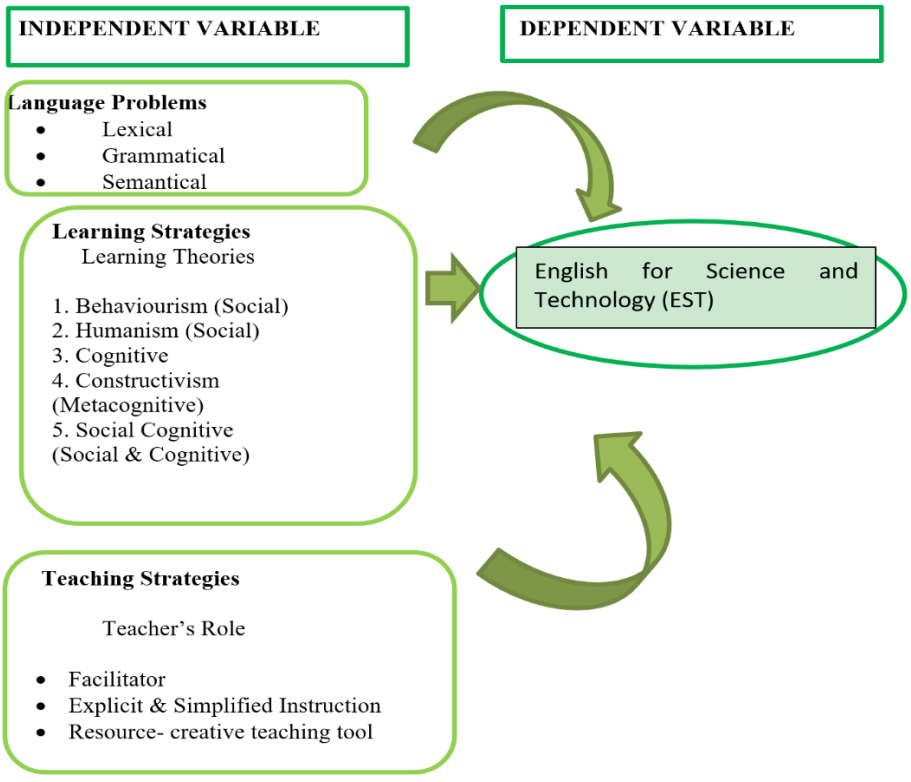

Figure 1. Conceptual Framework

The Conceptual Framework for this study is derived from the underlying theories of learning, problems, and strategies that need to be applied for successful learning in the classroom. English for Science and Technology (EST) depends on three Independent variables: language problems, learning strategies, and teaching strategies. As Chamot (2009) draws on strategy instruction, teachers and students must work hand-in-hand to create flourishing learning conditions. Therefore, the three Independent variables, language problems, learning strategies, and teaching strategies, promote good teaching and learning.

The major problem concerning language is lexical, which i word/vocabulary used in EST, grammatical, which concerns grammar rules in scientific writing, and syntax, highlighting sentence structure. A teacher must create an environment that suits learners' capabilities through creating teaching materials and simplified instructions using the second language according to students' abilities. The teacher initiates the strategy in which students in the EST classroom context apply appropriate strategies that suit their learning ability to understand the content and language effectively.

As Chamot & Harris (2019) proposed, the learning strategies Metacognitive, Cognitive and Social/Affective can be applied in the various learning theories according to the students' abilities in the EST classroom. This can be applied as in Behaviourism and Humanism theories of learning, social/affective approach would enable students to apply peer discussion or group discussion to understand an EST topic well.

The cognitive theory works well with the cognitive approach in learning among students, such as memorizing, taking notes, highlighting essential points, and others. Constructivism theory applies previous knowledge, which is a metacognitive approach in classroom learning. A teacher can relate students' prior knowledge in science and technology to the current topic in EST. The social-cognitive approach applies behaviourism and cognitive skills in the learning process. Therefore, students in EST class will engage in a social/affective approach to learning and cognitive thinking while discussing a scientific topic. These learning theories help teachers and students collaborate and understand EST content in a second language effectively.

Moreover, a teacher should use technology, ICT, PowerPoint slides, and videos to make learning activities exciting and engaging. The teacher must adapt different approaches to teach EST topics in order for students to be involved in the learning process. The teacher acts as a facilitator towards the learning process, which encourages self-directed learning among students. This will promote communicative use of the language in the classroom and improve terminologies and sentence structures. The desirability of the English teacher knowing something about science teaching methodology by creating meaningful communicative activity will evolve students' interest in the subject.

As Widdowson (1975) states, the focus is on the communicative function of use in the EST learning classroom and not on the linguistic forms of usage. He further supports that language usage will lead to correctness in using the language due to inappropriate classroom use. By facilitating the learning environment, students will learn to apply different learning strategies that will help ease the understanding of EST topics. Students will try different approaches in learning which enable them to comprehend the content and language easily. This study recommends the use of the CALLA approach as an effective strategy in a learning activity. Applying different strategies to different learning contexts will enable students to comprehend science and technology's content and language effectively.

4. Research Design

This study applies a mixed-method study which is a combination of quantitative and qualitative methods. Creswell & Creswell (2017) have proposed the Convergent Mixed Method to provide more reliable and valid research. Fraenkel, Wallen and Hyun (2015) state that the use of mixed-method research is appropriate as it explains the "relationship exists between two variables in-depth and also cross-validates them" such as problem in the language (scientific) and strategies to overcome them (p.556).

The Quantitative method was used on the students' Likert-scale questionnaires, comprising 30 questions based on the study's research questions. The pilot study of this research was undertaken and the reliability statistics were conducted on the three components of the research questions which are: Language Problem, Learning Strategies and Teaching Strategies. Table 1 shows the outcome of the pilot study reliability test.

Table 1. Reliability Statistics on Language Problems

Cronbach's Alpha	N of Items
.510	14

The reliability test shows Cronbach's alpha (0.864) which is less than acceptable level (0.700). The researcher conducted another pilot study with a group of 14 students in form four. This was because the initial pilot study was conducted among form five students whereas this study only takes into consideration form four students' perspective in learning EST. The researcher re-tested the questionnaire for all three components which are language problems, learning strategies and teaching strategies. Table 2 shows the outcome of the pilot study reliabilty statistics on language problems.

Table 2. Reliability Statistics on Language Problems

Cronbach's Alpha	N of Items
.756	14

The reliabilty test shows Cronbach's Alpha (0.756) which is more than acceptable level (0.700)

Table 3. Reliability Statistics on Learning Strategies

Cronbach's Alpha	N of Items
.821	14

Table 3 shows the reliability statistics on learning strategies tested in the pilot study. The reliability test shows Cronbach's Alpha (0.821) which is more than acceptable level (0.700).

Table 4. Reliability Statistics on Teaching Strategies

Cronbach's Alpha	N of Items
.756	14

Table 4 shows the reliability statistics on teaching strategies tested in the pilot study. The reliabilty test shows Cronbach's Alpha (0.756) which is more than acceptable level (0.700).

Sekaran and Bougie (2013) stated that Crobbach's alpha is a "reliability coefficient that indicates how well the items in a set were positively correlated to one another" (p. 292). Cronbach's alpha is computed in terms of the average intercorrelations among the items measuring the concept. "The closer Crombach's alpha is to 1, the higher the internal consistency reliability" (p. 293). Therefore, no adjustment was made as the results of the reliability test are consistent as seen in the tables above.

In addition, the Qualitative method was executed in the structured interview and classroom observation to study the nature of students in learning EST and to determine students language learning strategies and teachers teaching strategies employed in EST Instruction. In addition, 30 sample report writing scripts of students from the three states were transcribed qualitatively to look into students' language problems in EST report writing.

4.1 Study Location and Sampling Method

The sample consists of 150 Form Four students taking English for Science and Technology (EST) from three selected schools in three different states in Malaysia. They are labelled as School A, School B and School C. School A is located in Kedah, School B in Selangor and School C in Negeri Sembilan. These three schools were selected as samples for the study as these schools made English for Science and Technology (EST) a compulsory subject to be taken by science stream students in the Sijil Pelajaran Malaysia (SPM) examination. Therefore, the population ranges from 50 to 120 candidates in each school.

The instruments used in this study were questionnaires, interviews, observation and sample scripts. The questionnaire collection was carried out through a Likert scale from 1-5, administered for the questionnaire to the respondents in the respective EST classrooms. The researchers also conducted a structured interview with nine Form Four EST students from each school, which totalled up to 27 respondents – three excellent performers, three average performers and three weak performers from each school based on the school EST exam results in order to see the difference in student's responses. Thirty written scripts of EST students, classified as ten scripts from School A, ten scripts from School B and ten scripts from School C, were analysed to detect language problems in report writing. One classroom observation was carried out in each school to observe the EST teacher's teaching approaches. The results obtained from the study of the interviews, classroom observations, and scripts were used to triangulate with the questionnaire to conform to the reliability and validity of the research.

4.2 Data Analysis

In analysing the data gathered, this study applies a mixed method of qualitative and quantitative study. The researchers have applied the Convergent Parallel Design to analyse the data. The questionnaires gathered from the 150 students were analysed using the SPSS One-Sample T-Test**.** The researchers have applied the Statistical Package (Version 21) for the Social Science to tabulate data quantitatively. It is a "comprehensive system for analysing data. It is used to generate tabulated reports, charts, plots of distributions and trends, descriptive statistics and complex statistical analysis". For the 'Structured Interview', the responses from the total 27 students were interpreted in a report form, whereas the 'Classroom Observation' conducted in the three schools using 'Classroom Observation Checklist' was transmitted in a report. Sample scripts of 30 students from the three schools were transcribed in a written report form of writing. The researchers have applied Content Analysis using Thematic Approach to transcribe the qualitative data.

The structured interview, classroom observation and sample scripts of 30 students from the three schools were reported according to the content analysis thematic approach method.

5. Findings and Discussions

5.1 Research Question (RQ) 1: The Language Problems Students Face in Learning English For Science and Technology (EST)

Part A of the questionnaire and the 1st and 2nd questions in the structured interview measured RQ 1. Table 5 shows that School C had the highest score, followed by School B and School A. However, the scores were significantly lower than 3.0 for all three schools ($p<0.001$). This indicates that there was a significant amount of problems in learning EST in the study group.

Table 5. Outcomes for Overall EST Learning Problems

School	N	Mean (SD)	Mean Difference	Statistic	
				t	p-value
School A	50	1.85 (0.30)	-1.15	-27.532	< 0.001**
School B	50	2.24 (0.44)	-0.76	-12.377	< 0.001**
School C	50	2.86 (0.34)	-0.14	-2.913	0.005*

**Significant p-value at 0.001

According to Trimble (1985), the major problem for non-native students in EST is the grammatical and lexical in writing EST reports because it is compact in presenting ideas. Lexical problems such as sub-technical vocabulary and noun compounds are significant difficulties for non-native speakers of English in learning scientific English (Trimble, 1985). In addition, Maker & Zimmerman (2020) cites the essential elements in using English for Science such as sentence patterns in technical English, vocabulary in a scientific context, grammar structure in technical writing, cause and effect relationship in science, uses of prefixes, defining concepts in sentences, imperative verbs and root word in science, and tenses.

The findings show that School C had the highest score regarding the language problems students face in learning English for Science and Technology (EST), followed by school B and A, with the scores were significantly lower than 3.0 for all the three schools ($p<0.001$). Thus, the t-test results indicate a significant amount of problems in learning EST in the study group.

5.1.1 Questionnaire Response for Est Learning Problems

Students have voiced various responses to the EST learning problems raised by the researchers from the questionnaire answered among students from three different schools A, B and C. The most EST learning problems faced by school A and School B are understanding meta-language in EST, which is the language the teachers and learners use to talk about the English for Science and Technology language, learning and teaching. In addition, understanding some specialized vocabulary in EST has also become a problem in learning EST.

Understanding the word order in EST is also faced by students in School B while probing into the sentence patterns (grammar) in EST text is faced by students in School A and C. Some students in School A and B also have problems distinguishing between facts and opinion in EST. Understanding the differences between fact and opinion will help students evaluate the reliability and usefulness of texts they encounter. Besides, critical thinking is the best way to determine which statements are facts and which statements are opinions.

5.1.2 Interview Response for Est Learning Problems

From the findings, excellent performing students in all three schools stated that difficulties in understanding technical English are average to comprehend as they can only cope with technical language at an average level. Technical language covers terminologies that are typically best understood by people who specialise in that field or area. Thus, EST technical language encompasses terminologies that are related and specialised in science and technology.

Besides, for average performing students, there is a slight difficulty in understanding the technical use of language in EST, while weak performing students from all three schools agree that technical language is their most significant problem in understanding EST content. The difficulty in comprehending technical English differs among the excellent, average, and weak students from School A, School B and School C. Students, especially the mediocre and weak ones, cannot make connections or have poor synthesising skills. In addition, scientific terminologies used in a scientific text could also be another significant problem in mastering a text or writing a report efficiently as shown in Table 6.

Table 6. Response from Excellent, Average and Weak Students on Language Problem

Student		School A (n=9)	School B (n=9)	School C (n=9)
Proficiency Level	No			
Excellent	1	Science terms in English	Reading text	Pronunciation as a small number of terms used are only in EST and are not practised in daily communication
	2	Still not understanding some few English words in EST	Writing (difficulty in elaborating) and reading text	Pronunciation and terms
	3	Writing	Problems in terminology and content in text. Information Transfer	I have problem understanding certain technical terms
Average	1	Writing	Information Transfer	Usage of technical terms
	2	The science content in English	Understanding the content of the text	Usage of technical and scientific terms
	3	Writing	Reading text. Understanding the terminologies.	Usage of technical term, word structure and spelling
Weak	1	Difficult words	Information Transfer	Grammar
	2	Not familiar with technical terms	Writing	Grammar problems
	3	Grammar and vocabulary	Reading text (terminology, lifting the answer)	Grammar

5.2 Research Question (RQ) 2: What are the Specific Learning Strategies Students Adopt in Est Learning?

Part B of the questionnaire and the 3rd and 4th questions of the interview measured RQ 2. Table 7 shows that all the three schools had average overall scores lower than 3.0, and the differences were significant ($p<0.001$). This indicates that overall, the learning strategies were not adopted significantly in EST learning.

Table 7. Outcomes for Overall EST Learning Strategies Adopted

School	N	Mean (SD)	Mean Difference	Statistic	
				t	p-value
School A	50	2.50 (0.40)	-0.50	-8.873	< 0.001**
School B	50	2.39 (0.43)	-0.61	-10.086	< 0.001**
School C	50	2.73 (0.43)	-0.27	-4.487	< 0.001**

**Significant p-value at 0.001

The findings in (Table 7) show that all three schools had average overall scores lower than 3.0, and the differences were significant. This indicates that overall, the learning strategies were not adopted significantly in EST learning.

5.2.1 Questionnaire Response for Est Learning Strategies Adopted

The findings show that the EST learning strategies were not adopted significantly in EST learning in all the three

schools, School A, School B and School C. However, from the findings, it can be deduced that all the three schools, School A, School B and School C, were significantly adopting three same strategies in EST learning. The first one is using contextual clues, looking for familiar words, pictures and content to guide in guessing the meaning of unfamiliar words. Secondly, using additional materials to help students understand and answer the comprehension questions, and the last one is working with peers to complete assignments or solve comprehension problems. These three strategies are commonly used to meet examination needs and do not aim to expand students' horizons or heighten their high-order thinking skills (HOTs).

A student tends to look at what comes before and after that word when trying to decipher the meaning of a new word. Students in School A, School B and School C used contextual clues such as familiar words, pictures and the content to guide them to assess the meaning of certain unfamiliar words. In this case, comprehension failure could be a simple matter of not knowing the meaning of a word or a failure in specific reading skills and sub-skills. Context can be referred to the words surrounding unfamiliar words, which provide clues to the meaning of an unfamiliar word. These reading sub-skills will not lead students to infer and reflect.

Students in School A, School B and School C also were using additional materials to help in solving comprehension problems. Based on Abdullah (2014), the active students can be given first-hand material and visual representation as well as giving extra attention to weak students in studies is paramount to help struggling learners of English. Applying various approaches such as Total Physical Response (TPR), Cognitive Academic Language Learning Approach (CALLA), Language Experience Approach (LEA), Project-Based Learning (TBL), Presentation-practice--production (PPP), Grammar Translation, Cooperative Learning Activities and a few other relevant methodologies that suit the learners' abilities are encouraged in English teaching in a classroom.

Some students also prefer to work with peers to complete assignments or solve comprehension problems. Peer learning, or peer instruction, is a type of collaborative learning that involves students working in pairs or small groups to discuss concepts or find solutions to problems. This strategy in EST learning is also efficient since students can teach each other by addressing misunderstandings and clarifying misconceptions about the comprehension problems.

The least adopted strategy in School A, School B and School C was again to summarise important information that they read and gauging the strategies used after reading or planning out other strategies that could have helped. For students, they may use movies, outlines, maps, and notes when reading in order to understand comprehension problems. In order to understand the language of science and technology, it involves the same skills as the language learning process, which is reading, writing, listening and speaking. Programmes such as DIY (Do it yourself) on YouTube could also be recommended.

5.2.2 Interview Response for Est Learning Strategies Adopted

Findings in Table 8 show that excellent performing students seem to practice some metacognitive and cognitive learning strategies in learning EST. Based on Chamot (2009), metacognitive uses prior knowledge on understanding a present learning task in the classroom while cognitive is on-going learning tasks such as taking notes, memorising, and mind-mapping. From the findings, it can be said that excellent students practice metacognitive and cognitive learning strategies in learning EST since learners tend to apply various strategies while reading to make sense of the text.

Table 8. Response from Excellent, Average and Weak Students on Learning Strategies Employed

Student Proficiency Level	No	School A (n=9)	School B (n=9)	School C (n=9)
Excellent	1	Read materials related to science content.	Yes	Merge knowledge from Physics, Chemistry and Biology to further enhance the understanding of the EST lessons
	2	Yes reading newspaper	Obtaining extra knowledge from internet and reading materials	Relate the knowledge learnt in EST with general knowledge. Search on the net.
	3	Explore additional substances/sources to aid understanding	Mind mapping and weekly subscription of TheStar newspaper	Use background knowledge and do research. It helps in gaining a better understanding on certain topics such as space exploration.
Average	1	Reading article in internet	Do not understand some of the vocabularies	Do research and prepare a PowerPoint on topics that was assigned by teacher. Help to further understand the topic
	2	Learning from the internet	Reading material from other sources. Read the EST textbook and do the past year questions	Do research and prepare PowerPoint notes. Group work helped a lot in understanding and remembering.
	3	Yes, Didn't help a lot because couldn't understand. Very complex	Read question 3 times, read about general knowledge from other articles, through Internet	Refer to online notes and science reference book, do summary, understand facts better
Weak	1	No. Don't know how to study and what title to search on internet.	Reading text	Teaching and learning outside of the classroom
	2	No. Don't understand some of the method.	Yes	Using dictionary Do research from internet. It improved and widen vocabulary. Help to understand certain terms used in EST
	3	No. Have tried once but still don't understand	No	Yes. Do research in the Internet Help to understand EST better.

According to Chamot (2009), cognitive learning strategies may include making predictions, translating, summarising, linking with prior knowledge or experience, applying grammar rules, and guessing meaning from contexts. On the other hand, metacognitive learning strategies may include self-management or self-regulation, planning, and monitoring strategies. However, both strategies are the two most essential strategies required to understand the text because learners need to notice their thinking and plan and evaluate their processes (Chamot, 2009). In this case, cognitive and metacognitive strategies can help learners read independently and remember what they have read.

Excellent students also tend to relate EST learning with prior knowledge learnt in Science subjects such as Physics, Chemistry and Biology. This can relate them to present learning tasks in EST class and has helped good learners to understand EST. This may be due to topics and themes in the EST syllabus that are linked to the science subject curricula such as Physics, Chemistry and Biology. Nevertheless, the EST curriculum encourages the use of authentic materials in order for students to get familiarised with terminologies in science.

Besides, excellent students used additional learning tools such as online learning and science-related reading books to help them understand a specific topic in EST. On the other hand, average-performing students said PowerPoint hand-outs and newspapers help to grasp EST further. Finally, weak students prefer outdoor classroom learning, which helps them assimilate EST, such as study tours, attending exhibitions, and discussing with peers. Self-reading does not help as they cannot understand information independently due to technical content and language forms.

In order to master EST language and content, excellent students claim that Contextual Learning can help them most. Contextual learning may use contextual clues such as familiar words, pictures and the content to guide them to assess the meaning of certain unfamiliar words. Context can refer to the words surrounding an unfamiliar word, which provides clues to the meaning of an unfamiliar word that leads them to infer. Besides, direct learning through such an

approach enables promising students to excel in EST. The internet seems to be a suitable medium for average students to understand EST topics and language use (Omar, Amir & Mohamad, 2018).

On the other hand, weak students tend to rely on the help of secondary sources such as notes from mind-map or PowerPoint hand-outs, which is in simplified form to understand the EST content and language. In contrast, this group of students have the tendency to do outdoor learning activities such as Field Trip or Eco Trip which relates to EST topic in the curriculum and helps to give a clearer perspective of the topics in EST as practised in School C. Through the trips, students can be exposed to the science of nature and relate them to real-life situations and thus enhance their cognisance in EST language and content.

5.3 Research Question (Rq) 3: How does your Teacher Help You in Understanding Science Content and English Language during Classroom Teaching?

Part C of the questionnaire and the 5th question of the interview measured RQ 3. Table 9 shows that School A and B had average overall scores significantly lower than 3.0 ($p<0.001$) while School C had an average overall score significantly higher than 3.0 ($p<0.001$). Overall, this indicates that the teachers in School C significantly helped the students understand science content and English language during classroom teaching.

Table 9. Outcomes for Overall Teachers Help in EST Learning

School	N	Mean (SD)	Mean Difference	Statistic	
				t	p-value
School A	50	2.54 (0.29)	-0.46	-11.490	< 0.001**
School B	50	2.37 (0.19)	-0.63	-23.792	< 0.001**
School C	50	3.80 (0.21)	0.80	26.576	< 0.001**

**Significant p-value at 0.001

According to Abdullah (2014), Malaysian students lack three aspects of the English language: language proficiency, ideas, and confidence. To overcome these weaknesses, the teacher must have good classroom instruction, teaching practices and strategies in language teaching, active use of first-hand material and visual representation, and extra attention on weak students (Abdullah, 2014). For instance, teachers are encouraged to use various approaches such as Total Physical Response (TPR), Cognitive Academic Language Learning Approach (CALLA), Language Experience Approach (LEA), Project-Based Learning (TBL), Presentation-practice—production (PPP), Grammar Translation, Cooperative Learning Activities and a few other relevant methodologies that suit learners' ability. This study analysed ten strategies applied by teachers to help the students understand science content and English language during classroom teaching.

Overall, the results show that the teachers in School C significantly helped the students in mastering science content and English language during classroom teaching. The teachers in the school applied combinations of learning strategies as suggested by Chamot (2009). Teachers in School C adopted seven (7) teaching strategies in EST teaching. The most prominent teaching strategy for school C was to give significant importance in identifying the main point and supporting details and inference skills in EST.

These were followed by applying the chalk and talk method in EST class, getting students to brainstorm or come up with I-Think Mind Map, conduct field trips, execute English-Science-based competitions, and encourage students to google on EST topics and lastly refer to the textbook. Meanwhile, School A and B teachers only adopted three (3) and two (2) teaching strategies, respectively. Teachers in School A adopted teaching strategies of referring to textbooks, giving significant importance in identifying the main point and supporting details, and inference skills in EST and initiating one-to-one discussion. Teachers in School B used PowerPoint presentations to identify the main point and supporting details and inference skills in EST.

The result shows that the most effective strategy to help students from all the studied schools was to give significant importance in identifying the main point and supporting details and inference skills in EST. Teachers help in identifying essential points in notes to understand the topic well. In this way, teachers act as input givers to students in classroom teaching contexts.

Deng (2015) has stated that, in learning a content subject using English as a second language, an appropriate approach has to be employed in understanding the language of the content rather than apprehending language alone. This is because present 21st-century education comprises the understanding of content and language at the same time. Therefore, the strategy applied by the schools helps the students to grasp both content and language.

According to Puntambekar (1995), four factors influence learning. They are strategies applied by learners, learner's character towards learning tasks, the content of a text, and the learning task's nature. Therefore, these factors must be looked into in order for successful learning to occur in a classroom. From the results, teachers in School A have proven that referring to textbooks help the students to understand EST. However, Li, Mohd Razali, Nordin & Abd Samad (2018) have suggested that authentic materials by teachers stimulate motivation to create a variety of teaching styles and instill a positive attitude in learning EST. They also commented that the EST Textbook fails to be "reader-friendly" as it does not support the authentic material contents, which are more colourful visuals and well-elaborated materials. This engages readers' interest in EST teaching and learning in the classroom. They also add that with the present education transformation (2013-2025), EST materials in the classroom must gauge students' interest in acquiring linguistic competence and confidence.

The result also shows that School B and C teachers adopt group PowerPoint presentations as an effective tool in teaching EST. This strategy requires the students to independently identify the topic sentence and supporting details of the assigned topics to the respective group. Teachers should facilitate the learning process as this strategy helps the students be more independent learners by contributing to classroom activity and outside-of-class activity or self-study to plan, perform, and monitor their learning task (Zainuddin, Habiburrahim, Muluk, & Keumala, 2019).

Usage of the internet and social media could attract the students' attention. The result showed that the strategy of encouraging students to google information was least used in School A. However, teachers from School A and B used internet sources as additional learning input to better understand EST topics and the language of science. More handouts from secondary learning sources were given to help students understand EST. For instance, usage of social media was the least used strategy by both school B and C. Availability of vast information through an internet search and social media would benefit the students to understand EST as an alternative reference since the available EST textbook fails to be "reader-friendly" as it does not support the authentic material content which is a more colourful visual use and well-elaborated material (Kee, Abu Bakar, Nooreen & Arshad, 2018).

One to one discussion is least used by both school B and C. Communication Strategies (one-to-one discussion such as teacher-students or peer work in group discussion) is listed as one of the effective strategies of CALLA (Chamot, 2009). This strategy is essential to make sure the students interpret scientific ideas, and present information which requires students to present complex scientific ideas in simple and appropriate English (Curriculum Development Centre, 2006). However, this strategy may face communication difficulty, which involves time, speed and total students' participation, length of text and interaction limit (Oxford, 1990).

The result also indicates that the field trip strategy is the least adopted strategy in School A. Direct learning through such an approach enables promising students to excel in EST. The internet should be a suitable medium for understanding EST topics and language use for average performing students.

However, when lacking in language proficiency, students find it challenging to explain the matter, though the internet has helped them learn the content and language. Weak performing students tend to rely on the help of secondary sources such as notes from mind-map or PowerPoint hand-outs, which is in simplified form to understand the topics. These groups of students are inclined to outdoor learning activities such as Field Trips or Eco Trips, which are related to EST topics in the curriculum and help give a clearer picture of the topics in EST (Chamot, 2009).

6. Conclusion

From reviews of scholars and findings of this study on the problems in learning EST from students' perspective, the researchers would like to propose some suggestions on improving the teaching and learning of English for Science and Technology (EST) in the classroom. Firstly, teachers should not rely on the textbook as the only source of reference. The researchers suggest using additional materials in teaching EST in the classroom. The teacher should bring in carefully selected reading materials and visual aids to enable students to compare primary reading text to additional reading text. This creates or adds vocabulary to the students' 'thinking box' and gets them familiarised with the words. Reading enriches students' vocabulary use, and students learn to use varied terms in EST writing through the word choice used in additional reading text. Furthermore, learning and focusing on the English word order is a significant problem in understanding a text. Therefore, teachers should advocate more additional reading text to gauge students' interest in learning words and vocabulary.

The second aspect introduces the special language features of English for Science and Technology (EST). Teachers should not instruct the examination requirement or as in EST materials but simplify the instruction for two-way interaction in the classroom according to the present learning context of students. Special lexical items of the core language of EST should be emphasised in teaching a topic with simplified but meaningful sentences. More practices

should be given, such as teaching passive forms, as reporting in passive forms is ideal. However, in present students' language repertoire, the active form is mainly used in EST writing. Therefore, teachers should highlight the grammar rule in simple sentences rather than complex sentences. This will eliminate the fear that breeds in students' minds that EST language is difficult to be dealt with. Lastly, teaching techniques in EST should not focus on classroom teaching and merely exercises. Demonstrations, PowerPoint presentations, and real-life experience through field study should be inculcated to create variety in teaching and develop critical and creative thinking skills.

In conclusion, reasonably skilled instructors and the absence of local teachers who have already had experience teaching English for Science and Technology (EST) successfully will need to be looked into for future development in science and technology. Many students will be affected, and a severe shortage of trained teachers in this area must be given prior consideration. Practicing teachers must be trained to best use the rapidly growing amount of materials in science and technology to enable students to master the need for language in understanding scientific concepts effectively for the country's future needs.

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